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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	:	Examiner:
MANFRED KELLER	:	
Serial No.	:	
Filed:	:	Art Unit
For: SPECTRALLY BROADBAND LIGHT	:	
SOURCE OF HIGH OPTICAL POWER	:	

Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

TRANSMITTAL OF SUBSTITUTE SPECIFICATION

Dear Sir:

Transmitted herewith is a (1) Substitute Specification and (2) marked-up version of the Substitute Specification.

The Substitute Specification was prepared and is filed for the purpose of correcting the text of the English language translation of International patent application PCT/EP03/08441 that is submitted herewith. The translation, a literal translation of the International application that was prepared in the German language, contains numerous grammatical and syntactical errors that would unnecessarily complicate the examination of this application.

No new matter is added by the Substitute Specification.

The marked-up version indicates changes from the literal English language translation of PCT/EP03/08441 by strikeout (deletions from literal English translation) and underline (additions to literal English translation).

Respectfully submitted,

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Title: SPECTRALLY BROADBAND LIGHT SOURCE OF HIGH OPTICAL POWER

Inventor: Manfred Keller

BACKGROUND

Field of The Invention

The invention relates to a spectrally broadband light source. More particularly it pertains to a high optical power light source for use in fiber optic applications such as fiber optic interferometers and fiber optic gyroscopes (FOGs).

Description of The Prior Art

Superluminescent diodes have been used as light sources in fiber optic sensors (FOGs, in particular) to insure the two central requirements of (1) spectral broadbandedness and (2) optical power adequate for launching into the fiber. Such light sources are special components that are relatively expensive due to their low numbers. Commercially available, inexpensive alternatives include light-emitting diodes (LEDs) and laser diodes (Lds). LEDs do not fulfill the optical power criterion while LDs do not possess the required spectral properties.

SUMMARY AND OBJECTS OF THE INVENTION

It is therefore an object of the present invention to provide a spectrally broadband light source of high optical power for fiber optic applications that can be produced by means of an economic automatic mass production process.

The present invention addresses the preceding and other objects by providing a spectrally broadband light source of high optical power for fiber optic applications. Such light source is characterized by a monolithic linear array, arranged on a substrate, in particular a wafer or chip, of adjacent surface-emitting LEDs and a microoptics array arranged upstream of the monolithic LED linear array on the emission side at a prescribed

spacing, having optical functions individually assigned to the LED elements in such a way that, for the purpose of optimizing the optical power that can be launched into an optical fiber, the emission of the individual LEDs is focused onto an optical unit arranged upstream of the launch point of the fiber.

The optics unit is preferably designed as a spherical lens arranged at an end of the fiber into which light is radiated.

The foregoing and other features of the invention will become further apparent from the detailed description that follows. Such description is accompanied by a drawing figure. Numerals of the drawing figure, corresponding to those of the written description, point to the features of the invention with like numerals referring to like features throughout both the written description and the drawing.

BRIEF DESCRIPTION OF THE DRAWING

Figure 1 is a diagram of the layout of a spectrally broadband light source in accordance with the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The invention consists in the combination of a number of available techniques and elements, including high power LEDs, precise microoptics for beam focusing of the outputs of the individual LEDs, and optics for optimally launching the focused optical power into an optical fiber.

The actual light source is an array, preferably a lens array, in combination with high power, surface-emitting LEDs. The criterion of spectral broadbandedness is met with the latter. Such LEDs can be completely tested on the common wafer. The array consists of LEDs, adjacent, at a small spacing, on the

wafer. The number of LEDs employed is determined by the following optical units for beam deflection and focusing as well as the optical power required.

Special microoptics is mounted on the monolithic LED array that consists of an array of individual optical functions for focusing the more or less three-dimensional emissions of the individual LEDs on the chip into a parallel emission. The high optical power criterion is met by this summing of optical powers of the individual LEDs. The use of current methods in the field of microoptics yields complex optical functionality in conjunction with very good adaptation to the LED array. The focusing is very precise in adaptation to the individual LEDs of the array and is, if appropriate, optimized for each LED of the array with regard to direction of emission. Such requirements can be achieved very effectively with microoptics, specifically in a monolithic fashion in a single module. A further optics unit, for example a spherical lens mounted at the end face of the fiber is used for beam focusing and for optimizing the launch into the fiber.

Turning to the drawing, Figure 1 is a diagram of the layout of a spectrally broadband light source in accordance with the invention. The light source is constructed on a substrate 1, in particular a suitable wafer or chip substrate. A linear array of preferably-equally-spaced high power and surface-emitting LEDs 3 that can all be completely tested directly on the wafer with the aid of known test methods is arranged along a reference line or edge 7. A lens array 4, each of whose individual elements is respectively aligned with one of the LEDS 3 is located a short spacing in the direction of the emission of the LEDs 3. The optical elements of the lens array 4 are arranged and aligned so that the light beams of the individual LED elements 3 are focused onto collecting optics 5 (e.g. a spherical lens) arranged upstream of or on an optical fiber 6.

The following substantial advantages are achieved by the invention:

1. Essential processing and testing steps may be carried out as batch processing. This leads to substantially lower production costs, in particular in the case of chip production and in comparison with the costs for production of a single superluminescent diode having like properties.

2. The production of a chip with the LED linear array and the lens array can be performed by known mass production processes.

3. The chip can be adapted relatively easily to the current state of the art, easily utilizing growth potential that is accomplished in theory by the majority of chip manufacturers.

Apart from fiber optic sensors, the invention is also suitable for specific applications in metrology, in particular, telecommunications, and wherever spectral broadbandedness is required,(e.g. measurement/calibration of WDM or DWDM systems).

While this invention has been described with reference to its presently-preferred embodiment, it is not limited thereto. Rather, the invention is limited only insofar as it is defined by the following set of patent claims and includes within its scope all equivalents thereof.